AK Alaska District

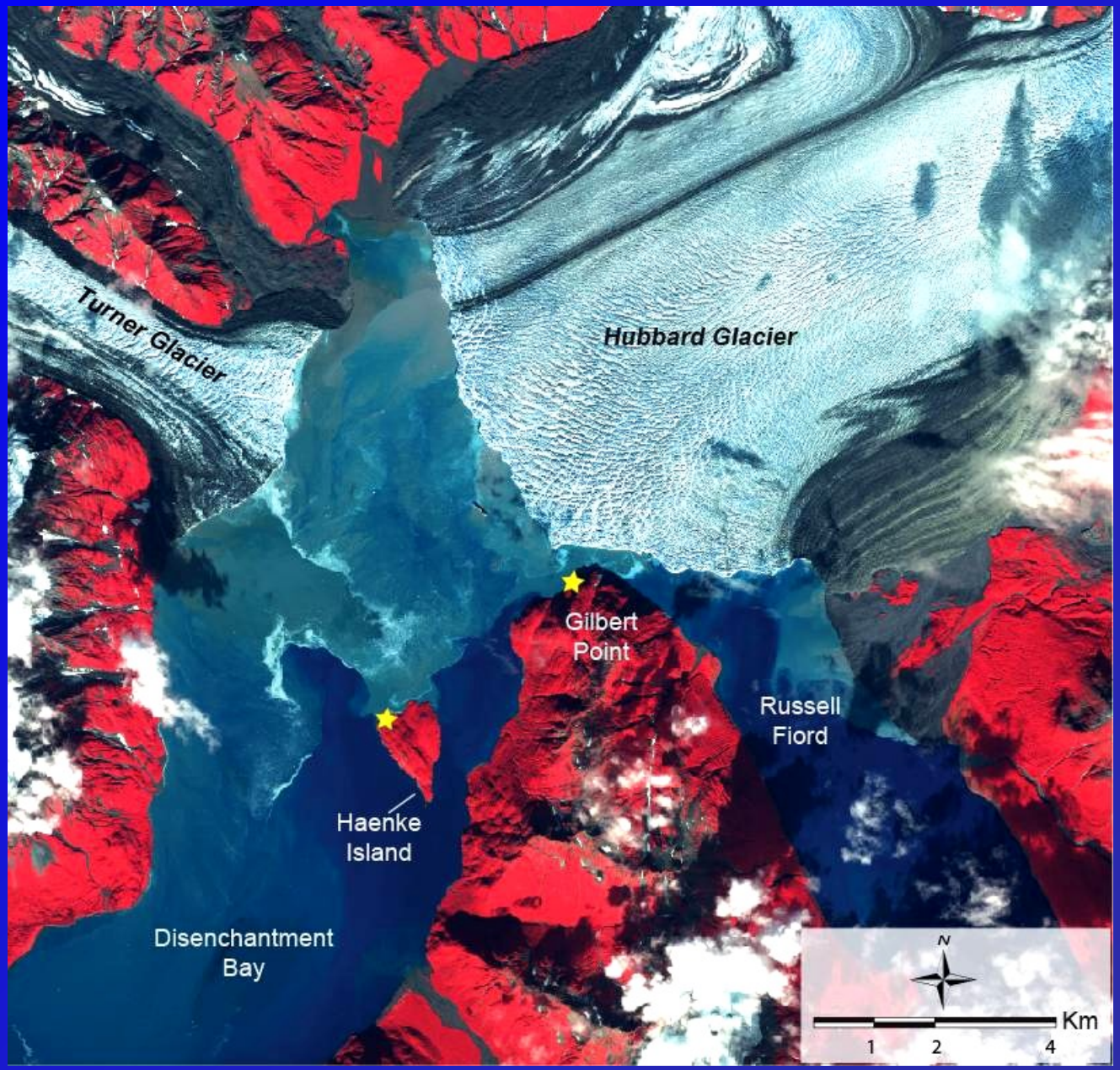
Innovations in the Yakutat Watershed Study

George Kalli PE
AK District Corps of Engineers

Purpose of Presentation

- Explain an innovative and collaborative study that has evolved from what must be one of the more unusual requests for help from the Corps of Engineers

Alaska District


Turner Glacier
Hubbard Glacier
Gilbert
Point
Russell
Fiord
Haenke
Island
Disenchantment
Bay
N
Km
1
2
4

Alaska District

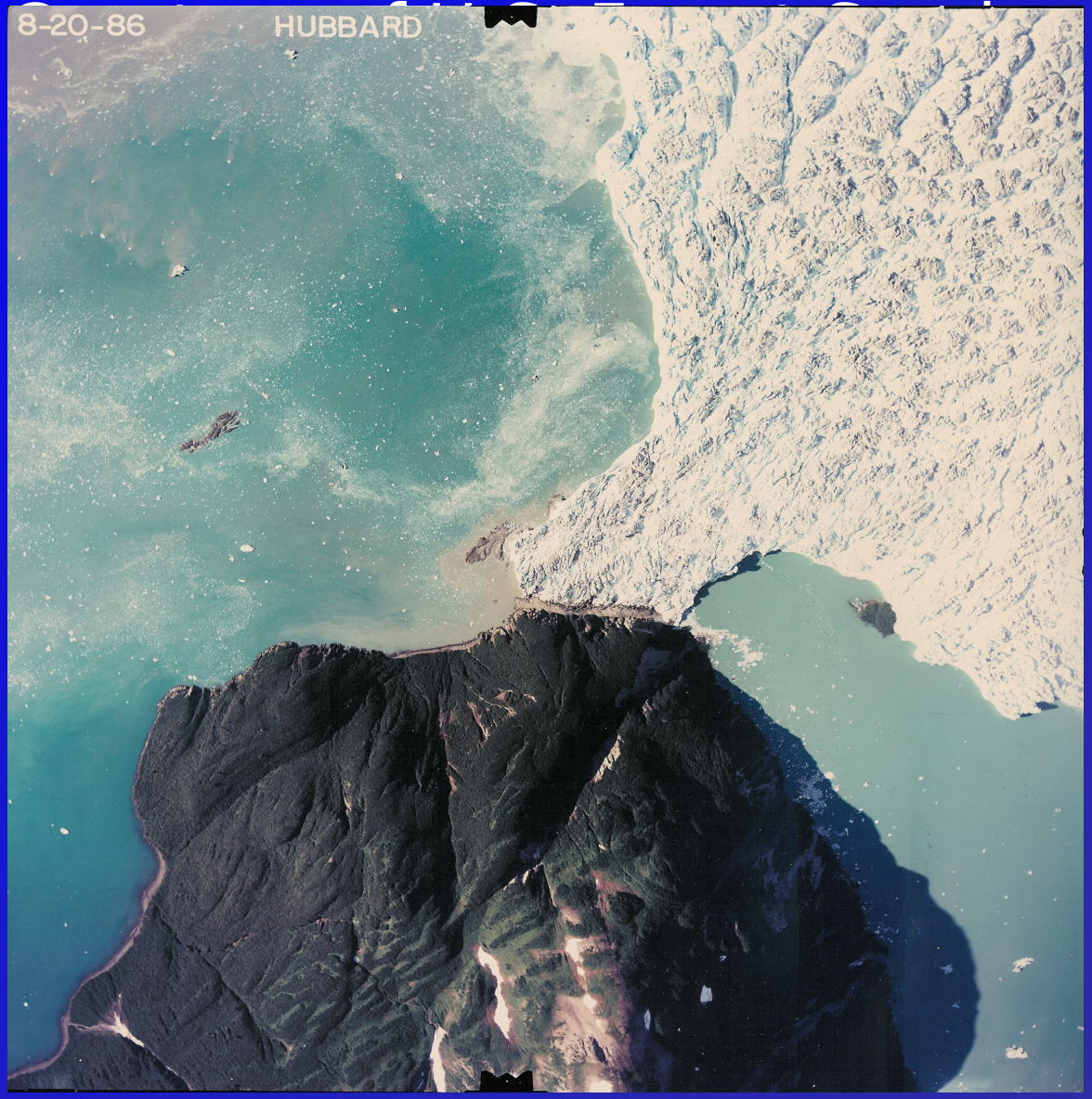
Hubbard Glacier Facts

- Thickening and advancing since first mapped in 1895
- In 1986 and 2002 glacier advancement isolated Russell Fiord from tidewater turning the fiord into a temporary lake
- Glacier will continue to threaten to close off Russell Fiord to form Russell Lake

Aerial View May 2004

Photo courtesy of Bob Johnson

Aerial Photo of 1986 Closure



Aerial View of 2002 Closure

Courtesy of U.S. Forest Service

Photo of 1986 Outburst Event

Courtesy of U.S. Forest Service

2002 Outburst Event

Why is Corps Involved?

- If Hubbard Lake reaches an elevation of 40 m (132 ft) above msl water will ‘overflow’ out of the lake
- Water will overflow through a low point (“notch”) in a moraine that bounds the southern shoreline of Russell Fiord and into the watershed of the Situk River
- Flood damage reduction study was initiated

Courtesy of Ned Rozell, University of Alaska Geophysical Institute

Courtesy of Ned Rozell, University of Alaska Geophysical Institute

Courtesy of Ned Rozell, University of Alaska Geophysical Institute

Courtesy of Ned Rozell, University of Alaska Geophysical Institute

Implications of Overflow Flood

- Potential flood damages to the airport
- Situk River fishery resources will be impacted
- Community of Yakutat itself is safe from overflow flood

Situk River

Photo courtesy of Greg

What To Do?

- Local representatives believed that the solution was an easy matter
  - simply divert the water headed for the Situk River into an adjacent, less utilized watershed

A “Simple” Structural Solution

Created from U.S. Forest Service GIS data

Gossip, Gossip, Gossip

- Upon spending additional time in Yakutat it became more and more obvious that we were dealing with a classic example of a vocal minority (with political connections)

Original Planning Objectives

- Decrease the uncertainty related to a Russell Lake overflow flood event
- Prevent/reduce potential Russell Lake overflow impacts upon the Yakutat Airport
- Prevent/reduce the potential flood damage impacts upon Situk River resources

Revised Planning Objectives

- Decrease the uncertainty related to a Russell Lake overflow flood event
- Prevent/reduce potential Russell Lake overflow flood impacts upon the Yakutat Airport
- Investigate means to reduce Yakutat's economic dependence upon Situk River resources

Recon. Phase Recommendations

- Feasibility watershed study approach to address two of the three revised planning objectives

- Analysis under the Flood Control and Coastal Emergency (FCCE) program to develop a contingency plan to protect the Yakutat Airport from an overflow flood

Unique and Persistent Uncertainty

- Probability and timing of next closure event
- Stability of dam at Gilbert Point
- Stability of the notch overflow area
- Hydrometeorology of Russell Fiord/Lake
- Prediction of overflow flowpaths
- Impacts upon fishery resources
- Recovery of fishery resources
- Economic impacts to the community
- Where is the glacier right now?

Watershed Study Scoping Process

- Many potential work items to help meet the planning objectives were identified
- Those items that would be a benefit to the community regardless if an overflow event occurred were prioritized
  - Sensitivity Analysis
- Collaborative efforts to meet the prioritized planning objectives were initiated

Prioritization of Planning Objectives

1. Investigate means to reduce Yakutat's economic dependence upon Situk River resources

2. Prevent/reduce potential Russell Lake overflow flood impacts upon the Yakutat Airport

3. Decrease the uncertainty related to a Russell Lake overflow flood

Watershed Study

- Pursued a highly collaborative study

- Collaborators include
  - US Forest Service
  - State agencies
  - Corps research labs
  - Academia
  - Scientific community

Collaboration and Innovation

US Forest Service (USFS)

- Local USFS office funded to lead in identification of economic diversification measures for the community
- Corps and USFS combined resources to conduct geotechnical drilling to address overflow notch stability
- Shared resources to establish a one-of-a-kind tidewater glacier monitoring system

Collaboration and Innovation

State Agencies

- Partnerships with Alaska DOT and Homeland Security established to develop a contingency plan to protect the Yakutat Airport from an imminent overflow flood

- Corps and Alaska Fish & Game biologists worked jointly to estimate species specific impacts and recovery rates to an overflow flood

Collaboration and Innovation

Cold Regions Research and Engineering Lab (CRREL)

- CRREL/NASA collaboration allowed the collection of high resolution LIDAR data of the potential flooded area
- CRREL is incorporating this data into hydraulic overflow flood models to reduce the uncertainty of impacts to the Yakutat Airport
- CRREL provides a link to potential collaborators from academia and government R&D agencies

Alaska District

Collaboration and Innovation

Corps Research Labs

- Technical expertise and access to cutting edge technology key to development of a one-of-kind tidewater glacier monitoring system
- People can now check the internet to see where the glacier is. **www.glacierresearch.com**
- Threat of a closure event occurring may now be assessed without travel to the site

Alaska District

Monitoring Equipment at Gilbert Point

Gilbert Point

Alaska District

Custom Built Equipment

Collaboration and Innovation

Academia

- University of Texas at Austin (UT) will be conducting marine geophysical and airborne radar investigations of Hubbard Glacier
- Taking advantage of cost-shared funds from UT
- Analyses will help determine the probability of a stable ice dam forming that would cause an overflow flood into the Situk River

Alaska District

Collaboration and Innovation

Conferences and Symposiums

- Numerous posters and presentations
- Invaluable method to get feedback and suggestions
- Provide additional opportunities for collaboration

Key Takeaway Points

- Don’t be limited to the original identified goals
- Don’t be limited to the original authorization
  - flood damage reduction study continued into a watershed study
- Don’t be limited to pursuing goals under one authority
  - also continued investigations under the FCCE

Key Takeaway Points

- Corps research labs are a vital resource for technical expertise and connections to academia and R&D efforts
- Going to the bar can be good research
  - Take the opportunity to talk to locals and value their opinions
- SUCCESS!
  - This approach enabled us to fund more work items than we anticipated

Alaska District

Thanks

George Kalli
(907) 753-2622
George.A.Kalli@usace.army.mil

Interesting Hubbard Glacier Facts

- Third largest glacier in North America
- Largest tidewater glacier in North America
- Hubbard is 25% larger than Rhode Island
- Approximately 122 km (76 miles) long
- Last overflow flood into Situk occurred around 1860
- Since current Corps involvement (2004) terminus observed to be up 120 m (400 ft) high and over 10.5 km (6 miles) wide

Alaska District

1986 Outburst Flood Facts

- Avg/peak inflow to lake estimated at 15,000/44,000 cfs
- Peak outburst discharge was roughly double the maximum recorded flowrate of the Mississippi River (1937 Memphis)
- Largest known historic glacial lake outburst flood
- Ice dam formed at Gilbert Point on June 1 and failed on October 8
- Russell Lake elevation reached 25 m (83 ft) above mean sea level before failure of the ice dam
- Rise of lake averaged 0.2 m (0.7 ft) per day
- Peak outburst flood discharge estimated to be 112,400 cms (3,970,000 cfs)

Alaska District

2002 Outburst Flood Facts

- Avg/peak inflow to lake estimated at (18,700/92,000 cfs)
- 2nd largest known historic glacial lake outburst flood after the 1986 outburst
- Morainal dam formed at Gilbert Point on June 16 and failed on August 13
- Russell Lake elevation reached 15 m (49 ft) above mean sea level before failure of the morainal dam
- Rise of lake averaged 0.2 m (0.7 ft) per day
- Peak outburst flood discharge estimated to be 52,400 cms (1,850,000 cfs)

Hubbard Glacier Research & Monitoring

US Army Cold Regions Research & Engineering Lab

- Home
- Real-Time Data
- Archive Data
- Photos
- Reports/Articles
- Updates
- Contacts
- Links
- Login

US Army Corps of Engineers

Hubbard Glacier Monitoring & Ice Dam Stability Research

As an approach to examining the threat that Hubbard Glacier poses to the community of Yakutat Alaska, the U.S. Army Corp of Engineers (USACE), Engineering Research and Development Center (ERDC) Cold Regions Research and Engineering Lab (CRREL) in cooperation with the USACE, Alaska district office, Anchorage and the United States Forest Service (USFS) are conducting investigations and scientific research into Hubbard Glaciers fluctuation activity. This site focuses on the dissemination of information obtained during these studies such as: Near-realtime monitoring information of the terminus advance rates, realtime climate information and other scientific activities such as ice dam stability analysis and modeling efforts using NASAs Airborne Topographic Mapper LiDAR, a source of high-resolution topography (~5cm) and watershed studies which seek to obtain holistic information that may lead to a better understanding of Hubbard Glaciers on going activities and its effects on the community of Yakutat.

© 2006 ERDC/CRREL

www.glacierresearch.com

Alaska District

Created from U.S. Forest Service GIS data